Richards) are related in a linear way to many of the properties of the elements and their salts.

From the average of the most logical values of the effective radii of atoms and ions of the alkali metals and the halogens it is found that the space functions of the third powers of the radii are as follows: for halogen ions, φ_0 (ratio of cube of radii $\times$ 6.063 $\times$ 10^{23} to gram-ionic volume) = .44; for halogen atoms, φ_0 = .25 (agreeing with van der Waal's postulate); for alkali ions, φ_0 = .25; and for alkali atoms, φ_0 = .52. In other words the volume of the halogen ion is roughly 44-25 that of the atom, and the alkali ion 25-52 of the corresponding atom. Upon this simple basis the molecular volumes of the alkali halides are found to be dependent as $3.35 \times 10^{24}(r^3_{\text{hal·ion}} + 1.76r^3_{\text{alk·ion}})$.

Finally there are many linear relationships to be found among the other elements: *e. g.*, the molecular volumes of the cuprous, silver and thallous halides and the *stability of the triammines* of these halides, to the atomic volumes or ionic sizes of cuprous copper, silver and thallium; the atomic volumes of calcium, strontium and barium (in some cases also lead), to the molecular volumes of practically any alkaline earth salt, or the stability of the hexammines of the metals (*e. g.*, Ca. 6 NH_3) to the ionic sizes of the alkaline earths; the molecular volumes of various sulfides, selenides and tellurides to the size of sulfide, selenide and telluride ions; the molecular volumes of the oxides to the atomic volumes of titanium, zirconium and cerium; and numerous linear relationships between the molecular volumes, stability, percentage contraction and heats of dissociation of complex compounds and the molecular, atomic and ionic dimensions of the constituents of the whole complex molecule. These will be considered in a separate paper.

The general method of representing the properties of salts as functions of the dimensions of their constituent ions (or of the atomic volumes of the constituent elements) is of such fundamental importance that an extensive study of the characteristics of these surfaces is now being made in collaboration with Professor A. C. Lunn and Professor W. D. Harkins of this university. As has been stated some of these *surfaces* are *planes,* while most of the others are *doubly* ruled.

GEORGE L. CLARK

UNIVERSITY OF CHICAGO,
FEBRUARY 3

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION L (1) HISTORY OF SCIENCE

THE History of Science section was organized on a temporary basis at the Chicago meeting of the American Association for the Advancement of Science, December, 1920. At the Toronto meeting, December, 1921, it was formally organized, and recognized by the Council of the American Association for the Advancement of Science as a sub-section in Section L (Historical and Philological)

This step now assures the future of the History of Science movement in the United States. The movement has been growing steadily, not alone in active interest and research by various scholars, but by the fact that our colleges, universities and technical schools are taking cognizance of its place in the curriculum of science and technology.

If we are, at all, to enter a new epoch of science teaching, and give more emphasis to the humanistic element in our sciences, it is evidently time now to consider the matter. Science, that which we love to call pure science, has been too long dominated by the ulterior motive of materialism.

The fact that the American Association for the Advancement of Science has recognized the value and purpose of History of Science, and accorded it a place in its comprehensive activities, indicates a step forward, not alone in the "Association" progress, but in science, and in educational methods as well.

A movement that can be fostered by two large and widely different organizations, such as the American Historical Association and the American Association for the Advancement of Science, is doubly assured of success and future stability, in relation to other intellectual movements.

The Toronto meeting was in charge of a local

committee, Dr. J. Playfair McMurrich and Dr. G. S. Brett, appointed by Dr. Burton E. Livingston, permanent secretary. To this committee great credit is due for the courtesies shown, in the matter of room selection and accommodations, lanterns, etc.

The program committee adhered to the policy adopted last year, by extending invitations to representative scholars to present papers, each paper illustrative of research in the field of some particular historical problem—technical and cultural.

The meeting was called to order by Dr. William A. Locy, chairman of the interim committee, Dr. Walter Libby acting as secretary *pro tempore*. The first paper on the program, "Leonardo da Vinci—Artist or Anatomist?" was given by Dr. J. Playfair McMurrich, of the department of anatomy, University of Toronto. Dr. McMurrich proved by reference to Leonardo's masters that Leonardo's initial interest in anatomy was that of the scientific artist. In discussing the address of Dr. McMurrich it was suggested that there was an analogy between the relation of Leonardo to the science of anatomy and the relation of Shakespeare to the science of psychology. In answer to a question, Dr. McMurrich expressed the view that Leonardo did not anticipate Harvey's discovery of the circulation of the blood. Continuing, Dr. McMurrich further remarked:

"Attention was called to the rapid improvement in anatomical illustration in the first half of the sixteenth century after a prolonged reign of crude conventionalism, and the attempt was made to connect this with the art renaissance which preceded that of science. The endeavors of the artists of the Renaissance to delineate accurately the human form led to better standards of observation, without which accurate drawing was impossible, and this reacted on the anatomists.

The great interest of the fifteenth century artists such as Pollajuolo, Verrocchio and Michelangelo in anatomy was noted and it was pointed out how great was the probability that Leonardo received his initiation into anatomical studies during his apprenticeship to Verrocchio. He approached anatomy from the standpoint of the artist, but his genius quickly led him to inquiries into the conditions underlying and determining surface form, and the artist became an anatomist.

The second paper was by Dr. Walter Libby, of the University of Pittsburgh, "History as the Record of Human Possessions." Dr. Libby pointed out the value of taking stock of the paraphernalia of civilization—such as metals, buildings, books, musical instruments, machines—in the succeeding historical epochs. A study of cultural equipment enables one to view the history of the race as a progressive development. The Greeks passed from barbarism to the highest civilization when they came in contact with the cultured accumulations of the Egyptians, Babylonians and Cretans. Similarly, the Arabs ceased to be a rude, uncivilized people only when they gained possession of the books, buildings, etc., of the Mediterranean basin and of Mesopotamia.

Dr. William A. Locy, Northwestern University, followed with the third paper entitled "The *Hortus Sanitatis* (1491) and Related Books." Dr. Locy's address was splendidly illustrated. He not only used the lantern to show pictures of plants and animals taken from the *Hortus Sanitatis* of 1491 and similar works, but he displayed photostat reproductions of selected pages of this famous work.

"The *Hortus Sanitatis* is a famous knowledge book on natural history and popular medicine, printed for the first time in 1491 and in many editions thereafter. It was widely circulated and of immense popularity. It appeared in that interesting period of intellectual development just preceding the full bloom of the Renaissance and it throws light upon the rebirth of the scientific attitude of mind. Representing a phase in the struggle of the human spirit to get away from the mystical and subjective method of thinking, which had prevailed for centuries, it is an important human document and is not to be looked on as merely a curiosity of antiquarian interest. A mental revolution was coming on, destined in the following half-century to establish observation in place of dependence on authority as a method of advancing knowledge, and books like the *Hortus Sanitatis* were harbingers of this revolution.

"Other related books such as the *Book of*

Nature, printed in 1475, and the *Garten der Gesundheit,* especially since the *Garten der Gesundheit* of 1485 is of higher quality, and some of its illustrations represent the earliest printed pictures of animals and plants drawn from nature. The publication of these sketches in 1485 'forms an important landmark in the history of botanical illustration, and marks perhaps the greatest single step ever made in that art.' They were unequaled until the publication of the herbals of Brunfels and of Fuchs half a century later. The *Hortus Sanitatis* was more widely distributed, and since it was a larger and later production, generally it has been assumed that it contained the best pictures of the period—but this is wrong. The much rarer *Garten der Gesundheit* of 1485 (often confused with the *Hortus Sanitatis*) is the only member of that family of books which has excellent pictures drawn from nature.

"As a publisher's venture in the early days of printing, the preface of the *Hortus Sanitatis* contains a clever appeal to the commercial instinct, saying, that by help of the information contained in the book, people 'with quite small expense to themselves will be able to compound helpful remedies and perfect medicines' without the necessity of doctors and apothecaries. Another feature of the book, however, had greater influence on the thought of the time: through its 1,066 pictures and descriptions attention was directed to the productions of nature and information was spread regarding plants, animals and minerals. Almost the whole structure of modern science rests on such humble beginnings."

Dr. G. S. Brett, of the department of philosophy, University of Toronto, presented an unusually interesting paper in that it gives the philosopher's point of view in the history of science, "The Theory of History in Relation to the History of Science." Dr. Brett also discussed the idea of the history of science and the difficulties that lie in the way of making history of science a branch of academic instruction.

This paper was presented as a contribution to the problems of method. Reference was made to the status of the Section and to recent discussions on the subject, especially to the paper by Professor E. H. Johnson, contributed to SCIENCE December 16, 1921. The writer argues that the difficulty of finding a place for history of science in a curriculum was partly due to a want of clear ideas on the nature of the subject. This point was further explained by a sketch of the development of historiography, which was shown to be dependent on a variety of interests. The early tendency to comprehensive records gave place to a more restricted aim which virtually made history equivalent to political annals. The idea of progress brought to light the idea of continuous historical development, and led to a philosophy of history which attempted to organize the facts as proof of the theory. This failed because the actual historical sequence did not conform to the theories, as for example the attempts of the Romantic school to demonstrate a rational solution. After tracing the tendency in modern historical work to break new ground in the history of literature, the history of general types, such as "federation" or "liberty," and even the "history of historians," the writer argued that a specified type of history was required for the history of science. In its essential feature, this would not be identical with biographical work on men of science, or with the type of work which naturally forms the background of any particular study. While monographs on these subjects are indispensable preliminaries, a good history of science must coordinate the achievements with the total conditions, social and intellectual, which culminate in them. It was argued that in this field there is a unique opportunity for studying the cumulative growth of culture, and for exhibiting the way in which ideas persist and are transformed. The lack of a sufficient literature, neither sporadic nor biased by national interests nor disproportionate in the treatment of topics, makes the subject difficult to teach. It was also the best proof that the nature of the subject was not properly understood.

In the absence of the next speaker and the secretary, the following paper was read by title only: "Historical Basis for the Scientific Stagnation of the Middle Ages," by Dr. Harry E. Barnes, of the department of the history of thought and culture, Clark University, Worcester, Massachusetts.

Dr. Louis C. Karpinski, University of Michigan, reminded the Historical Section of the centennial of Hermann von Helmholtz. He presented in brief, but most interestingly, the great German's place in the history of science.

"The history of science concerns itself with the historical and logical sequence of scientific concepts. The process of development by which man arrives at fundamental laws of the universe in which we live is a vital study, having great possibilities for furthering the advance of science. Studies in this field have shown that the part of particular individuals, even men of great genius, is much less than is commonly supposed. The genius is that fortunate individual who arrives upon the scene when the accumulation of observations enables the formulation of some general law for whose reception and acceptance the way has been prepared.

"Obviously only few men can be successful in attaching their names to fundamental laws. Prominent in the group is Hermann von Helmholtz, who in 1847 at the age of 26 gave a complete statement of the laws of the conservation of energy. Were one to attempt to characterize in a few words his extraordinary range of researches, one would say that Helmholtz brought biological and physical problems under the dominion of mathematical formulas and methods."

Dr. Karpinski further states, "In a centennial recognition of a life of such great significance for mankind, the purpose is both historical and inspirational," and shows further the historical contribution of Helmholtz to civilization by a detailed characterization of his life.

"Towards the end of his life in 1894, the great German was working upon the similar but more inclusive 'principle of least action' which he hoped to extend mathematically so as to apply to all forces of nature. Helmholtz, it should be noted, resolutely set himself against any commercialism or financial exploitation of his researches. His words on this subject are worthy of serious consideration to-day in every great American university, where in some departments a tendency exists to mix devotion to science and learning with devotion to private interest. Helmholtz says: 'Whoever, in the pursuit of science, seeks after immediate practical utility, may generally rest assured that he will seek in vain. We must rest satisfied with the consciousness that he too has contributed something to the increasing fund of knowledge in which the dominion of man over all forces hostile to intelligence reposes.'" (For the complete paper see *Scientific Monthly*, July, 1921).

Following Dr. Karpinski's paper, the election of officers was held, resulting in the selection as given:

For Vice-president: Dr. Wm. A. Locy, Northwestern University.

For Secretary: Frederick E. Brasch, James Jerome Hill Library, St. Paul.

For Sectional Committee: Dr. Walter Libby, University of Pittsburgh; Dr. Florian Cajori, University of California; Dr. George Sarton, Carnegie Institution; Dr. Louis C. Karpinski, University of Michigan.

In addition to the officers elected, the chairman (Dr. Locy) appointed a committee consisting of Dr. Lawrence J. Henderson, Harvard University, Dr. Walter Libby, University of Pittsburgh, and Dr. G. S. Brett, University of Toronto, to approach the representative of the *Encyclopedia Brittanica* with an offer of cooperation in revising the parts of that reference book that relate to the history of science. Dr. Libby is chairman of this committee.

The next meeting of the History of Science Section will be held in Boston, December, 1922. Plans are therefore being devised for a larger and more effective meeting. In fact, in view of the American Historical Association meeting in New Haven, December, 1922, there is every reason to suppose a joint session would prove most profitable. This occasion ought to prove unique, as it is extraordinary for a given subject to be considered by a scientific and a historical association at the same time.

For the splendid notes and the courtesy in acting as secretary *pro tempore*, the secretary wishes to acknowledge his indebtedness to Dr. Libby.

FREDERICK E. BRASCH,
Secretary

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